

Name: Sample Solution

Email address (UW NetID): _____

CSE 160 Winter 2016: Final Exam

(closed book, closed notes, no calculators)

Instructions: This exam is closed book, closed notes. You have 50 minutes to complete it. It contains 7 questions and 8 pages (including this one), totaling 70 points. Before you start, please check your copy to make sure it is complete. After the 8 pages of the exam, there is a syntax cheat sheet that you may remove. Turn in all 8 pages of the exam, together, when you are finished. When time has been called you must put down your pencil and stop writing. **Points will be deducted from your score if you are writing after time has been called.**

Total: 70 points. Time: 50 minutes.

Problem	Max Points	Score
1	4	
2	3	
3	4	
4	14	
5	20	
6	15	
7	10	
Total	70	

1) [4 pts]

a) Give two examples of a **mutable type**:

`list, dictionary, set`

b) Give two examples of an **immutable type**:

`int, float, string, tuple, boolean`

2) [3 pts] Write code that would produce an "IndexError" error

```
lst = [1, 2, 3]
print lst[3]
```

3) [4 pts] Write the output of the code below in the box here:

```
sum = 0
for x in range(2, 8):
    if x % 2 == 0:
        for y in range(x):
            sum = sum + y
print 'sum:', sum
```

MY ANSWER:

sum: 22

4) [14 pts] Given a list of lists of integers, fill in the function `index_of_max_unique` below to return the index indicating which sub-list has the most unique values. For example:

`index_of_max_unique([[1, 3, 3], [12, 4, 12, 7, 4, 4], [41, 2, 4, 7, 1, 12]])`
would return 2 since the sub-list at index 2 has the most unique values in it (6 unique values).

`index_of_max_unique([[4, 5], [12]])` would return 0 since the sub-list at index 0 has the most unique values in it (2 unique values).

You can assume that neither the `list_of_lists` nor any of its sub-lists will be empty. If there is a tie for the max number of unique values between two sub-lists, return the index of the first sub-list encountered (when reading left to right) that has the most unique values.

```
def index_of_max_unique(list_of_lists):  
    # Your code here  
    max_index = 0  
    max_unique = 0  
    for index in range(len(list_of_lists)):  
        num_unique = len(set(list_of_lists[index]))  
        if num_unique > max_unique:  
            max_unique = num_unique  
            max_index = index  
    return max_index
```

5) [20 pts total] a) [10 pts] Write a function called `read_zoo_animals(filename)` that takes the name of a file as a parameter. You can assume that the given file contains lines of the form: `zoo_name animal` where each `zoo_name` and `animal` are strings that contain no spaces or punctuation and are separated by a single space. Here are the contents of a sample input file:

```
point_defiance monkey
national panda
woodland_park bear
national elephant
national panda
```

Your function should read in the given file and return a dictionary mapping each `zoo_name` to a list of the animals the zoo has. For a given zoo, the animals in that zoo's list should appear in the order they appear in the file. It is o.k. to have duplicate animals in the list for a given zoo.

You may assume the file name provided is valid and that the file is formatted as described and includes at least one `zoo_name animal` pair. Calling `read_zoo_animals` on the file

above would return this dictionary: `{'point_defiance': ['monkey'], 'national': ['panda', 'elephant', 'panda'], 'woodland_park': ['bear']}`

```
def read_zoo_animals(filename):
    # Your code here
    result = {}
    input = open(filename)
    for line in input:
        items = line.split()
        zoo = items[0]
        animal = items[1]
        if zoo in result:
            result[zoo].append(animal)
        else:
            result[zoo] = [animal]
    input.close()
    return result
```

5) (cont.) b) [10 pts] Write code in the main function that will call the `read_zoo_animals` function written in part a) to open a file called `local_zoos.txt` and print the results in EXACTLY the following format. For the sample input shown in problem 5a) the output would be:

```
point_defiance:
  monkey
national:
  elephant
  panda
  panda
woodland_park:
  bear
```

`zoo_names` may be printed in any order, but each zoo's list of `animals` should be printed in **alphabetical order**. Don't forget the colon at the end of each `zoo_name` and a single space at the beginning of each `animal` indenting it.

```
def main():
    # Your code here

    zoo_dict = read_zoo_animals("favorite_zoos.txt")

    for zoo in zoo_dict:
        print zoo + ":"
        sorted_animals = sorted(zoo_dict[zoo])
        for animal in sorted_animals:
            print " " + animal
```

6) [15 pts] Note: THIS PROBLEM IS NOT RELATED TO PROBLEM 5!!

You are given the following class definition:

```
class Zoo:
    def __init__(self, zoo_name):
        '''zoo_name: a string representing name of zoo'''
        self.name = zoo_name
        self.animals = []

    def add(self, animal):
        '''animal: a string representing an animal'''
        self.animals.append(animal)
```

a) Write the code for the method below that is also a part of the class Zoo:

```
def release_animal(self, free_animal):
    '''Remove all occurrences of free_animal from this zoo.
    free_animal: a string representing an animal.
    Returns the number of occurrences that were removed.
    The free_animal string must match exactly (e.g. same
    case) with the name of an animal currently in the zoo
    in order for that animal to be removed. '''
    # Your code here
    occurrences = self.animals.count(free_animal)

    for occurrence in range(occurrences):
        self.animals.remove(free_animal)

    return occurrences
```

6) (continued)

b) Write the code for the method below that is also a part of the class Zoo:

```
def get_num_animals(self):  
    '''Returns the total number of animals in the zoo as an  
    integer.'''  
    # Your code here:  
  
    return len(self.animals)
```

c) Write code in the `main` function to add a lion and a tiger to the `seattle_zoo`. This code is outside of the class Zoo.

```
def main():  
    seattle_zoo = Zoo("woodland_park")  
    # Your code here:  
    seattle_zoo.add("lion")  
    seattle_zoo.add("tiger")
```

d) Describe a change to the `Zoo` class that might cause a **client** of the `Zoo` class to have to modify its code.

Changing name of methods or class, number of parameters or expected type of parameters or return type of methods. Removing a method from the class. Any change to the interface the client may be using.

e) Describe a change to the `Zoo` class that would NOT cause a **client** of the `Zoo` class to have to modify its code.

Changing HOW a method is implemented, or the name of a parameter. Changing the internal representation of the animals belonging to the zoo (say from a list to a dictionary). Adding a new method.

7) [10 pts] a) **Draw** the entire environment, including all active environment frames and all user-defined variables, **at the moment that the MINUS OPERATION IS performed**. Feel free to draw out the entire environment, but be sure to CLEARLY indicate what will exist at the moment the **MINUS** operation is performed (e.g. cross out frames that no longer exist).

b) When finished executing, **what is printed out by this code?**

MY ANSWER:

120

c) **How many different stack frames** (environment frames) are active when the call stack is DEEPEST/LARGEST? (Hint: The global frame counts as one frame.)

MY ANSWER:

4

```
def smile(x):
    return x + 4
```

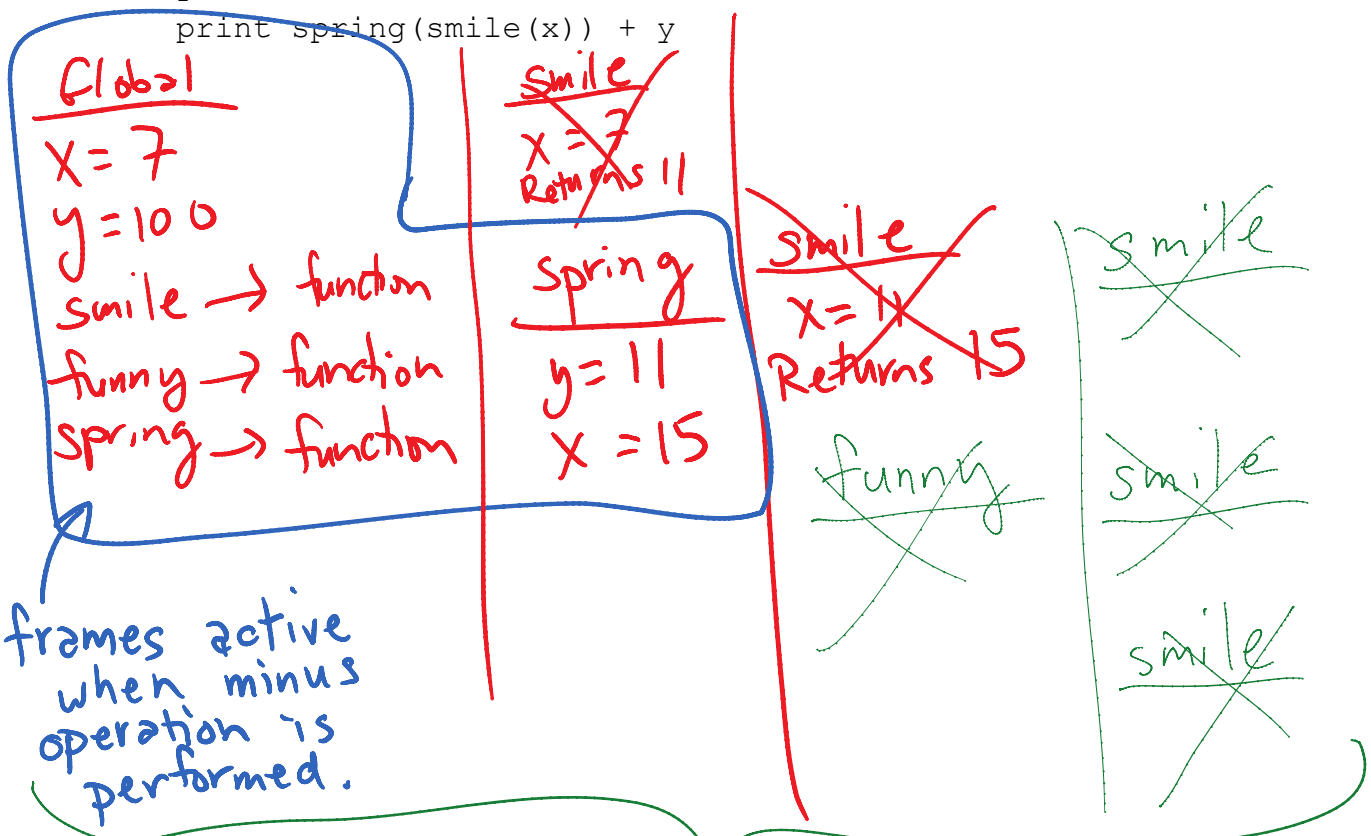
```
def funny(x):
    y = smile(smile(x))
    return y + smile(x)
```

```
def spring(y):
    x = smile(y)
    return funny(x - y)
```

← ****Draw the environment at this point****

```
x = 7
y = 100
print spring(smile(x)) + y
```

After the minus is executed, **spring** calls **funny**, then **funny** calls **smile** three times in a row, resulting in a depth of 4 stack frames at the point we are inside any one of those three calls to **smile**.



4 stack frames at the deepest point